

Pollution Prevention

The basic steps for developing and implementing a pollution prevention program are:

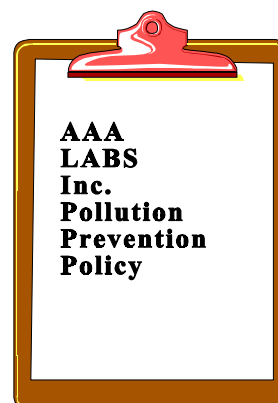
- Put together a p2 team
- Review your options
- Develop a p2 plan
- Put the plan in place
- Track your results

1. Put together a p2 team and get top management support for the effort. Personnel on a p2 team should be knowledgeable about the processes and interested in reducing wastes. The best people to have on the team are those directly involved with lab work. It helps to have several people on the team in case someone leaves the company. If you are a smaller company then one person can do the job. Be sure to set aside time and resources so that the p2 team can do their work. Laboratory safety committees are an excellent starting place to begin forming a p2 team.



1.1 Management Activities

Management support and leadership are a key to a successful p2 team. Management can support by



developing a supportive atmosphere for p2 and this can be demonstrated with a pollution prevention policy. A p2 policy doesn't have to be complicated other than a simple and clear statement of goals with regards to your company. The p2 team can designate a leader or a leader can be designated by management.

1.2 Staff Activities

Train and educate staff about the importance of p2 to your company. Train staff on how to look for pollution prevention opportunities. Good examples of p2 activities are listed as case studies in Appendix D.

1.3 Team Checklists

The following checklist contains the key elements to help you in developing a p2 team and management support. When a p2 team is in place you should be able to answer yes to all the questions. Any no answers or ? are marked if additional information or assessment is needed.

Pollution Prevention Team Checklist			
	Yes	No	???
• Do you have a p2 policy?			
• Has the p2 policy been signed by a manager?			
• Is the policy posted where all employees can see it?			
• Have employees been told about the p2 policy and it's purpose?			
• Has the p2 team been formed?			
• Are the team members knowledgeable about the processes in your lab?			
• Has a team leader been chosen?			
• Does management provide the team with time and resources needed for p2 planning and implementation?			

(Table from The Silver Council, Code of Management Practice, 2/19/97)

2. Review Your Options



In this phase of the p2 process, we are only reviewing the options that are available. The options for pollution prevention

should be reviewed by the p2 team members and prioritized (section 3.2) before implementing them (section 4).

Some p2 opportunities are simple and may be implemented immediately while others are complex and require resources and training. Many p2 opportunities are simple housekeeping practices that your laboratory may already be practicing.

A series of checklists follow and are intended to help you review some possible opportunities for waste reduction. Pollution prevention options for laboratories can be broken down into the following areas:

- 2.1 Purchasing & Inventory
- 2.2 Spill Control
- 2.3 Container Security
- 2.4 Drain Protection
- 2.5 Facility Plumbing & Cleaning
- 2.6 Process Practices
- 2.7 Sewer Use Practices
- 2.8 Waste Disposal Practices

out with a "yes", "no" or "?". Anytime a "?" is filled out it means more information is needed to evaluate that opportunity. Reference information is provided along with each question.

Checklists

The following checklists are to assist you with identifying alternatives for further consideration. The ??? should be checked if more information is needed to answer this question. The last column contains reference information.



The following checklists can be filled

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2.1 Purchasing & Inventory Checklist

	Yes	No	??	Reference Information
Do you purchase chemicals in large volumes?				Large volumes increase the possibility of excess chemicals. To avoid costly surplus, purchase chemicals in small containers to fulfill immediate lab needs.
Do you use all the materials in a container?				Use all materials in a container before beginning new bottles.
Do you label all containers?				Proper labeling is a simple and powerful way to reduce many of the environmental hazards and costs associated with chemicals used in the laboratory.
Do you restrict access to chemicals?				Locking chemical storage areas and limiting access may help your business reduce chemical use.

- ❖ Purchase the smallest container needed
- ❖ Label all containers
- ❖ This photo shows secondary containment provided by each shelf
- ❖ These chemicals are all being closely tracked with computer scanning labels



2.1 Purchasing & Inventory Checklist (Continued)

	Yes	No	??	Reference Information
Do you track your chemical usage?				<p>Tracking what the material was used for and how it was disposed of can lead to significant advances in your business' pollution prevention efforts. Tracking a chemical from purchase to disposal can reduce duplicate purchases. Allowing for redistribution of surplus materials can reduce waste generated from partially filled containers or out-of-date stock.</p> <p>Whatever method you use to track purchases (i.e., computer program, ledger books, note cards, etc.) accuracy relies on the cooperation of all lab employees and should be incorporated in your employee training.</p>

Chemical purchasing practices and inventory control have been identified by the American Chemical Society as prime opportunities for reducing waste generation in the laboratory. Obsolete and expired chemicals can contribute significantly to a laboratories waste stream. So purchasing strategies play an important role in your pollution prevention plan.

Chemical Stock Ledger

Name	Molecular Formula	CAS No.	Source	Size	Classification	Date	Location

Column 1 : Name as printed on container

Column 2 : Molecular formula, provides a simple way of researching

Column 3 : Chemical Abstract Service (CAS) number registry number for unambiguous identification of chemicals

Column 4 : Source


Column 5 : Size of container

Column 6 : Hazard classification for safe storage, handling and disposal

Column 7 : Date of acquisition to ensure useful life of chemical

Column 8 : Storage location for use when multiple locations exist

2.2 Spill Control Checklist

	Yes	No	??	Reference Information
Does your facility conduct equipment inspections on a routine basis to identify leaks or equipment malfunctions?				Routine inspections of your lab's process, storage, and waste treatment areas should be conducted on a regular basis to identify leaks and malfunctioning equipment. Identifying problems at an early stage helps reduce spills and other uncontrolled releases.
Do you have the proper types of equipment to handle spills?				 <p>Spill cleanup equipment should be present for the various types of chemicals that you use in your lab.</p> <p>Maintain sufficient quantities of spill control materials (absorbents, drains plugs, acid/base kits etc.)</p>
Do you have sufficient cleanup equipment in case of spills?				
Do you have procedures in place to handle leaks or spills?				Fire departments require spill containment, and material segregation of reactive materials, around storage areas to minimize the spread of any spilled material. Ensuring a quick and proper response to leaks and spills can help you reduce waste generated by the cleanup

				of spills. Keep an emergency spill plan available and educate employees in its use. Training your employees also satisfies legal requirements.
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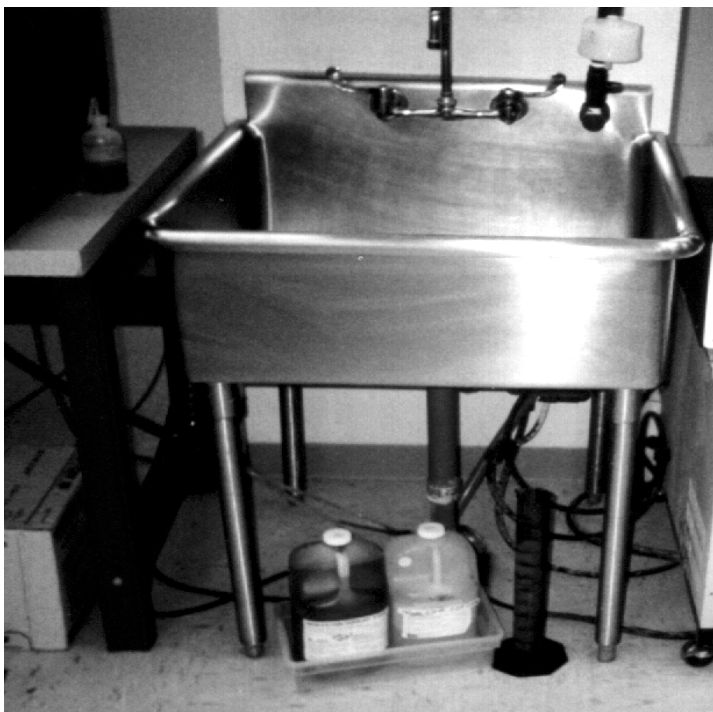
2.3 Container Security Checklist

	Yes	No	??	Reference Information
Do you store containers in secure areas?				Never store chemicals on shelves or cabinets located above sinks. Store in chemical cabinets and on low shelves. Always latch doors on chemical cabinets. Never use a sink as secondary containment.
Do you provide secondary containment around containers?				Use secondary containment for all liquid chemicals stored on shelves, countertops, or cabinets. If extra containment is not feasible for shelves or cabinets, store containers behind barriers at least 1/5 the height of the tallest container.
Do you keep secondary containment dry?				Keep secondary containment dry at all times.
Do you properly segregate chemicals?				Keep incompatible chemicals segregated in case of an accidental spill. Use separate storage cabinets, closets, or physical barriers such as secondary containment, berming, or trenching.
Have you considered ordering chemicals in plastic coated bottles?				Order nonbreakable containers whenever possible.

Do you leave chemical bottles open?				Never leave a chemical bottle open or unattended.
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2.4 Drain Protection Checklist

	Yes	No	??	Reference Information
Do you hold chemicals in sinks?				Never store chemicals in sinks with drains.
Are your sinks protected from spills?				Install lips around all sinks, especially cup sinks on countertops under hoods.
Are floor drains protected from spills?				Protect floor drains with removable plugs, berms, or permanently seal them. Do not store chemicals without secondary containment next to drains.
Are safety shower drains protected from spills?				Never store chemicals next to a safety shower drain. Protect safety shower drains.




❖ The two chemical containers stored near this sink are kept in secondary containment to avoid spills and prevent chemicals from entering the nearby floor drain.



❖ This 30% Hydrochloric Acid bath is labeled, stored in secondary containment and covered.

2.5 Facility Plumbing & Cleaning Checklist

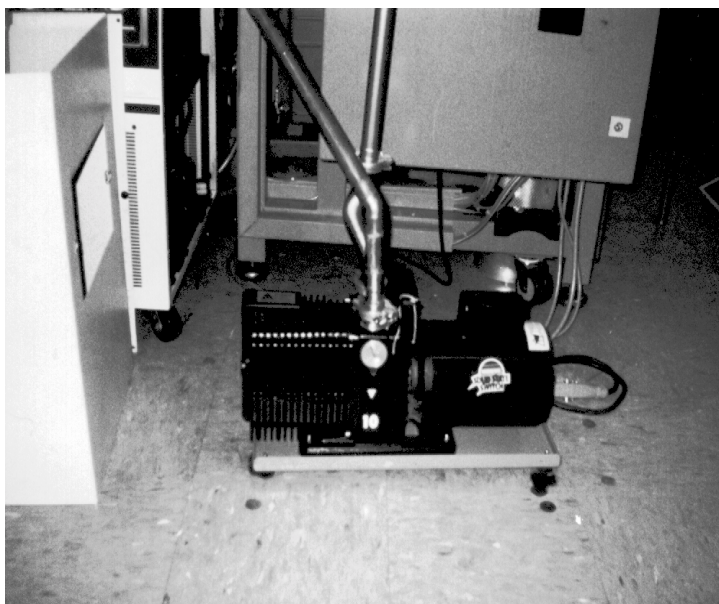
	Yes	No	??	Reference Information
Do you routinely maintain your neutralization sump or pit?				<p>Proper maintenance of acid neutralization sumps should be done periodically. Limestone may be eliminated by controlling the pH of materials before they are discharged. Assume sump contents are hazardous if unknown because they are a collection point for sediments, solvents, and mercury.</p>  <p style="text-align: right;">❖ Acid Neutralization Sump</p>
Are deposits from low points in plumbing properly disposed of?				<p>Sediments from low points in plumbing should properly be handled and disposed of. Sediments and mercury will tend to collect in low points making the waste</p>

				hazardous. Assume sediments are hazardous if unknown.
Do you use aspirators or water seal vacuum pumps?				Aspirators and single pass water seal pumps use a lot of water and may entrain and discharge chemicals to the sewer. Alternatives include recirculating water seal pumps and mechanical pumps.

2.5 Facility Plumbing & Cleaning Checklist (continued)

Do you use vacuum pumps, water or steam aspirators?				These should be protected with a suitable trapping device in the vacuum line (i.e. a cold trap for volatiles) to prevent contamination of the pump fluid.
Do you dispose of your vacuum pump oil properly?				Vacuum pump oil may become contaminated with the chemicals being vacuumed. Characterize and dispose of it according to hazardous waste regulations.

- ❖ Secondary containment beneath this vacuum pump prevents spills of vacuum pump oil.
- ❖ Cold traps on vacuum pumps are used to minimize the amount of solvent that gets into vacuum pump oil. This allows oil to be disposed of as used oil instead of hazardous waste.



Facility Plumbing & Cleaning Checklist (Continued)

	Yes	No	??	Reference Information
Have you reviewed the ingredients in your cleaners?				<p>Review the ingredients in your cleaners. Phenolic compounds may be present in disinfectant cleaners. Phenols are toxic and some are bioaccumulative. Use phenols only when required. The alternative to phenols are quarternary amine substitutes.</p> <p>If you use chromic acid in your glassware cleaner, consider that chromic acid is highly toxic. Whenever possible use substitute cleaning agents that don't contain chromium. Do not pour chromic acid down the drain. See Appendix C, table 1 for a list of substitute cleaners.</p>
Do you minimize use of cleaning products?				Minimize the use of cleaning products and cut your costs. Premeasured dose dispensers can be used to ensure products like phenols are used only to the extent needed.
If using a distillation unit, does it have secondary containment?				If you are using a distillation unit, your distillation unit should have secondary containment to prevent any spills from entering floor drains and to protect workers.



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2.5 Facility Plumbing & Cleaning Checklist (Continued)

	Yes	No	??	Reference Information
Do you keep hazardous wastes from entering the laundry?				Keep articles like thermometers and spill cleanup rags out of the laundry to prevent discharge to sewer.
Have you considered installing water conservation devices?				Consider installing water conservation devices. Flow restrictors on sinks and rinse tanks will save water. Reduce rinse times whenever possible. Also, water recyclers on distillation units can save tens of thousands of gallons of water per year.



❖ Distillation units with secondary containment provided by the fume hood.

2.6 Process Practices Checklist

	Yes	No	??	Reference Information
Are sequential operations adjacent to each other?				Sequential operations should be adjacent to avoid excess material handling. This reduces the potential for material and precious metal losses and reduces accidental spills.
Are process solutions prepared by trained personnel? Are the minimal amounts of chemicals needed prepared?				You can often minimize waste and improve the consistency of process solutions by assigning a limited number of properly trained personnel to mix chemicals.
Does your facility maintain fume hoods, collectors and fans in proper working condition?				Fume collectors and ventilation fans should be maintained in top working condition. Good maintenance practices will reduce health risks and allow better collection of airborne vapors and particulate.

2.6 Process Practices Checklist (Continued)

	Yes	No	??	Reference Information
Does your facility have a formal facility inspection plan?				Regular inspections of your facility's storage, waste treatment, and production areas will help maintain optimal production and identify equipment and process malfunctions early. This will help you identify equipment and process problems early and provide time to correct problems before a small problem becomes a major issue.

2.7 Sewer Use Practices Checklist

	Yes	No	??	Reference Information
Are you familiar with the allowable limits for concentrations of chemicals that can be safely sewered?				Being familiar with the concentrations of metals can help you properly dispose of wastes. Follow the City's Sewer Use Ordinance and RCRA's hazardous waste regulations for how to properly dispose of chemical wastes. See Appendix B for contacts.
Are you familiar with the prohibited pollutants?				The prohibited pollutants are listed in the City's Sewer Use Ordinance (see appendix F) and include pollutants that could create a fire hazard, corrosives, oils above 100 mg/l, and others are listed.
Do you properly dispose of metal standards?				Metal standards may contain high concentrations of metals not suitable for sewer disposal. Keep track of expiration dates to avoid wastes.
Are you recycling mercury bearing wastes as much as feasible?				Always recycle mercury bearing wastes. Wastes such as broken thermometers can be recycled. Don't pour any amount of mercury into the sewer. Refer to Appendix C table 4 for a list of recyclers or check with your hazardous waste disposal company (see table 6 in appendix C).


2.7 Sewer Use Practices Checklists (Continued)

	Yes	No	??	Reference Information
Do you minimize your chances of having mercury spills?				There are substitutes available to the use of mercury in thermometers. Mercury spills can be minimized as well as exposure risks. For a list of nonmercury thermometer suppliers refer to Appendix C, table 5 or your suppliers.
Have you considered alternative ways to handle waste solvents?				Distillation of solvents may provide attractive financial and environmental benefits depending on the amount of solvents used. Appendix G contains a worksheet to determine the payback period. For a list of lab still suppliers refer to Appendix C, table 2.
Do you recycle all metal bearing wastestreams to the extent feasible?				Refer to Appendix C, table 3 for a list of metal reclamation companies or your waste disposal company.
Do you generate silver bearing wastes?				Silver in photographic fixer or laboratory solutions at concentrations above 5 mg/l (ppm) should be treated or recycled. Refer to Appendix C, tables 7 & 8 for a list of companies.
Do you have a hazardous waste disposal company?				For more information, refer to Appendix C, table 6.

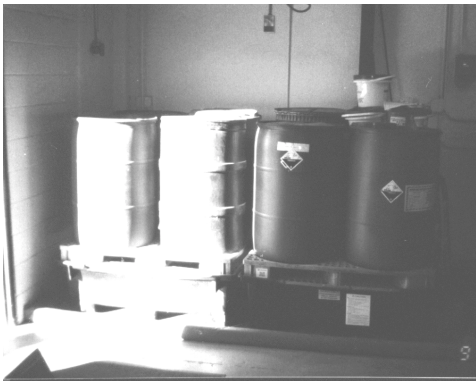
2.8 Waste Disposal Practices Checklist


	Yes	No	??	Reference Information
Do you keep track of all the materials you send to disposal?				<p>You should maintain and keep on file all manifests, receipts and tracking materials for wastes you have disposed.</p> <p>To reduce the amount of paperwork and business liability you should review your processes and material use to reduce the amount and number of wastes you currently generate. By not generating the waste you will not have to have it disposed.</p>
Do you commingle like wastes prior to disposal?				<p>Commingling is the process of combining similar wastes into a larger container. For commingling, wastes should not be reactive and should be of the same hazard classification.</p> <p>Compared to lab packs, commingling can be much cheaper (up to 1/4 the cost) than using lab packs. Due to absorbent materials and waste container space Lab packs typically can only accommodate 14 gallons of wastes in a 55 gallon lab pack. Commingling can accommodate the full 55 gallon drum space. (from: "Laboratory Waste Management: A Guidebook," ACS Taskforce on Laboratory Waste Management, ACS, Washington, D.C., 1994).</p>

2.8 Waste Disposal Practices Checklist (Continued)

	Yes	No	??	Reference Information
Do you keep wastes types properly segregated?				Commingling should be done carefully and employees should be trained in the procedures. Simple errors such as combining incompatible wastes can endanger your business and/or generate a mixed hazardous waste. This can make your wastes difficult to handle and expensive to have disposed. One example is the segregation of non-chlorinated solvents from chlorinated solvents. Mixing a small amount of chlorinated solvent in with the nonchlorinated solvents will cause the entire container to become a hazardous waste and will be expensive to have handled and disposed of.
Do you segregate distinct wastes prior to disposal?				<p>Segregating wastes can greatly reduce the amount of hazardous wastes you generate, thus reducing your disposal costs. If you mix one pound of hazardous waste with 9 pounds of nonhazardous waste you will have 10 pounds of a hazardous waste.</p> 

				❖ This photo shows segregated wastes.
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2.8 Waste Disposal Practices Checklist (Continued)				
	Yes	No	??	Reference Information
Do you provide secondary containment around waste storage areas?				<p>Secondary containment will help prevent leaks and spills from leaving the waste storage area.</p>  <p>❖ These 55 gallon drums of waste are being stored on secondary containment pallets and are surrounded by a berm for tertiary containment.</p>

Do you properly label waste containers?				 <p>Hazardous waste containers should be labeled as hazardous waste. This will help to prevent comingling of nonhazardous with hazardous wastes.</p> <p>❖ The hazardous waste container shown in this photo is labeled and distinguished from normal waste by a red container.</p>
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3. Develop a p2 Plan

After your p2 team has gone through the checklists of options and may also have other ideas, it is time to develop a p2 plan. The purpose of the p2 plan is to prioritize which options are most attractive to you in terms of costs, feasibility, and environmental benefits.

3.1 Screening Your Options

It is recommended that the following questions be asked of all the options

that were identified:

- What are the environmental benefits of this option in terms of waste reduction and employee safety.
- What are the costs associated with this option?
- How much money will it save in time and materials?
- How difficult is this option to

implement?

for implementation

- List the responsible person(s)
- Write down new procedures

3.2 Prioritizing the Options

The options identified need to also be prioritized. You can use a point system or prioritize them in the following manner:

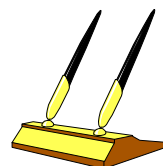
- High priority - these will need first or immediate attention
- Medium priority - needs to be looked at within 3 to 12 months
- Low priority - consider these within the next 1 to 2 years

This stage of reviewing your options and prioritizing them is very important and will make the difference between a p2 plan that actually gets done and one that exists only in writing.

3.3 Writing the p2 Plan

Before you are ready to write the p2 plan, the options are reviewed and prioritized. Now you are ready to put your plan into writing. Here are some recommendations for your first p2 plan draft:

- Start with only the high priority options
- List each option and the purpose
- Include in your plan a time frame



The following two worksheets may be used to screen your p2 options and develop a written p2 plan.

Worksheet for Screening Options

Date:

Option: _____

1. What is the potential for reducing waste and providing other environmental benefits?
2. What is it going to cost in time and materials?
3. How much money will it save in time and materials?
4. How difficult is it to implement?

Pollution Prevention Plan Worksheet

Date:

Option or Activity:

Implementation Date:

Responsibility:

Records:

(Sources: The Silver Council, Code of Management Practice, 2/97)

4. Put the Plan in Place

Here are some suggestions for implementing your p2 plan:

- Make the plan known - it helps to post your p2 plan where it will be visible to employees. Make your employees aware of the plan and keep them informed of successes and failures.
- Provide training and education - as needed, arrange for training and education of employees regarding the p2 plan. Make sure that all employees with any responsibility for the plan have been trained to carry out their tasks.
- Provide resources - resources may include time and/or materials to implement the p2 plan.



5. Track Your Results

After you have implemented the p2 plan, be sure to keep track of how the plan is working for your business. It is recommended that a review every six months be done on the successes and failures of the plan.

Consider the following things when reviewing the plan:

- How much waste has been reduced?
- How much has it cost to implement the options?
- Have you saved money or prevented accidents with the plan?
- Evaluate which options are successful (have they reduced waste or saved money?)
- Evaluate which options have failed (have not reduced waste or costs more money than they are worth).
- Keep your employees informed of successes and failures of the plan.
- Have you put your high priority options first? Continue with medium and low priority p2 options after high priority items are completed.

